Monolith User Manual

Empirical Audio Rev. 1.0

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1. Performance

There are primarily two reasons for replacing an AC-derived power supply with a battery supply, Dynamic Current Capacity and Isolation from the AC mains.

1.1. Dynamic Current Capacity

Batteries, and particularly Lithium-Ion batteries have very low internal resistance, so when the device requires a high-amperage short-term current burst, a battery is more capable of providing this than a typical AC-DC supply. This is particularly the case with linear AC supplies, which have the lowest RF noise. Linear supplies tend to be slower in reacting to changing loads. Switching power supplies are faster reacting and tend to regulate better, but are still not as stable as a battery and they have the disadvantage of some level of RF noise that can pollute your audio.

This ability of the battery to supply high dynamic currents without much change in the voltage is key to achieving better sound quality from devices like the Off-Ramp and Pace-Car. It is kind of like connecting Hoover Dam directly to the device. It is a very "stiff" supply. This kind of power source does not care about the changing load. It is always stable.

1.2. Isolation from the AC Mains

The design of the Monolith enables the battery output to be completely isolated from the AC mains, just as if it were battery-only. This has the advantage of eliminating one more ground connection to the AC mains, which creates another ground-loop. Miminizing the number and size of the ground-loops in a system is key to achieving a low-noise RF and hum-free result.

2. Function

The Monolith Lithium Battery power supply is designed to provide 12VDC power to the Off-Ramp or Pace-Car products. It provides selectable DC power to its output from an AC adapter or from internal Lithium-Ion batteries.

The Monolith contains chargers for the internal LI batteries. The charge current comes from the connected AC adapter, which has the capacity to both recharge the batteries and power the device, either the Off-Ramp or Pace-Car. When the battery output is not enabled, either in **Standby** or in **Ext. DC** output modes, the LI batteries are being charged, assuming that the AC adapter is connected. The user should leave the AC adapter connected at all times. The Monolith is not designed to be used stand-alone without the AC adapter. If the Monolith is shipped or stored, the current draw with no AC adapter connected is very low, but this should be avoided for long periods.

When the batteries are fully charged, the green **Batt Chrgd** LED is illuminated. When this LED is illuminated, it is possible to enable battery output by actuating the **Ena Batt** momentary switch position. If the batteries are fully charged, the red **Batt Output** LED will illuminate and battery voltage will appear at the output.

When the battery is enabled and the red **Batt Output** LED is illuminated, the batteries will power the output until the voltage reaches a level that will start to affect sound quality. When this occurs, the output will automatically and transparently switch to the **Ext DC Output** and this LED will become illuminated. At this point, the AC adapter is directed to the output and the batteries are being recharged. This allows one to listen to music without interruption when the batteries need recharging.

The green **Batt Chrgd** LED will not illuminate when the selector switch is in the Standby position. The batteries are still being charged, and may be fully charged. The way to determine the charge state of the batteries is to put the selector switch in the **On** position.

2.1. Typical Usage

Typical use is to enable the battery in the morning and listen to music from LI battery all day and then it automatically switches to AC adapter and recharges quickly at night and is ready the next morning to do it again. The selector switch remains in the **On** position.

The only intervention required is to enable the battery output by actuating the momentary switch to **Ena Batt** when you are ready to listen again.

Typically, the user will not put the selector switch in the **Standby** position unless you are going on vacation and want to power down the Off-Ramp or Pace-Car. Doing this will cut the power to the Off-Ramp or Pace-Car causing the playback software to hang. It is best to exit the software or at least stop music playback before going to **Standby**.

It is not possible to enable the battery output unless the batteries are fully charged. The reason for this is to achieve the maximum life out of the batteries, hopefully over a thousand recharge cycles. Trying to use the batteries when they are not fully charged will age the batteries prematurely.

It is possible to shorten the usage cycle however. If your circumstances require it, you can put the selector switch in **Standby** position when you are done listening to music, forcing a recharge cycle before the batteries really need recharging in order to achieve the next fully charged state sooner. This will actually increase the battery life. If you switch to **Standby** and quickly switch back to **On**, the battery will disengage and Adapter voltage will go to the output without the output going to zero volts. This can allow you to leave the playback application open.

2.2. Protection Features/Warnings

Since Lithium-Ion batteries are very high-energy and prone to fire and explosion when they are discharged too fast, charged too fast or achieve high temperatures, it is important to have safeguards in place. It is the use of the new protected LI cells that makes the Monolith possible. These cells have built-in protections for temperature, overcharge and over-discharge. In addition, the charging circuits of the Monolith have overcharge limiting, so for charging, they are double-protected. This is important in case any of the protection circuits fail.

Warning: The output of the Monolith does **NOT** have a fuse in series, so it relies on the over-current protection of the cells themselves. This is intentional in order to provide the lowest impedance possible. As a result, the user must be **CAREFUL** not to short the end of the umbilical cable. Empirical Audio recommends that when in battery output mode (**Batt Output** LED illuminated), the user should not plug or unplug either end of the Umbilical cable.

Optionally, an umbilical with an in-line fuse can be supplied.

3. **Front-Panel:**

3.1.1. **Input Select Switch**
Input selector for **Standby**, **On** and **Ena Batt**.
Standby cuts power to the output.
On can be AC adapter or battery to the output.
Ena Batt directs battery to the output, but only if they are fully charged.

3.1.2. **Ext Input LED**
Green LED that illuminates when the AC adapter is connected.

3.1.3. **Batt Chrgd LED**
Green LED that illuminates when all of the batteries are fully charged.

3.1.4. **No Output LED**
Green LED that illuminates when there is no output voltage. Batteries are charging, but **Batt Chrgd** indicator will not illuminate, even if they are fully charged.

3.1.5. **Ext DC Output LED**
Yellow LED that illuminates when the AC adapter voltage is directed to the output. Batteries are charging and the **Batt Chrgd** indicator will illuminate when they are fully charged.

3.1.6. **Batt Output LED**
Red LED that illuminates when the battery voltage is directed to the output. The batteries are not being charged.

4. Back-Panel

4.1. +12VDC input

This is the power input for the Monolith. It powers both the output and the internal battery charger, except when battery output is selected. In this case, it only powers control circuits. An AC adapter, generally 70Watts is used. The older low-power adapters that were used with the Off-Ramp and Pace-Car cannot be used. The connector is 2.5mm and center positive.

4.2. DC Power Output

Only two of the five pins (4 and 5) are used on this connector, as marked. This is where the Umbilical Cable plugs-in.

Do not plug or unplug the Umbilical cable to this connector when the Batt Output LED is illuminated. This enables a high-energy shorting hazard.

5. Battery Replacement Instructions

Typically when the batteries will not fully charge anymore, all 6 batteries are replaced. However, it is possible that a battery may fail prematurely, so the instructions below allow replacement of a pair of batteries in this case. There are 6 batteries, but there are actually 3 pairs of batteries. Each pair must be replaced together, ensuring correct orientation. **It is critical that the batteries be installed in the correct orientation to prevent fire, burns, potential explosion and circuit board damage.**

If the customer is not comfortable replacing the batteries themselves, Empirical Audio can do this for a small fee.

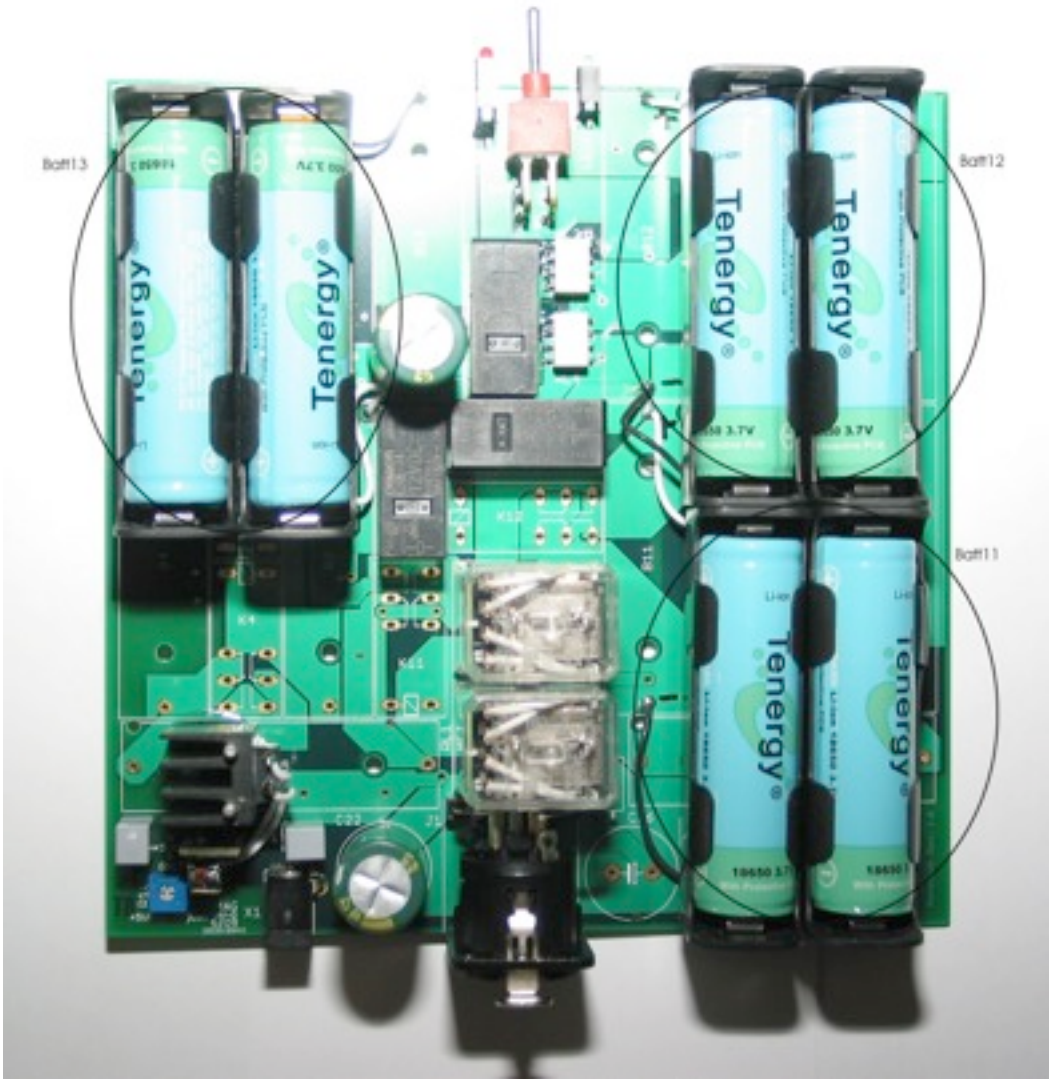
5.1. Replacing all batteries

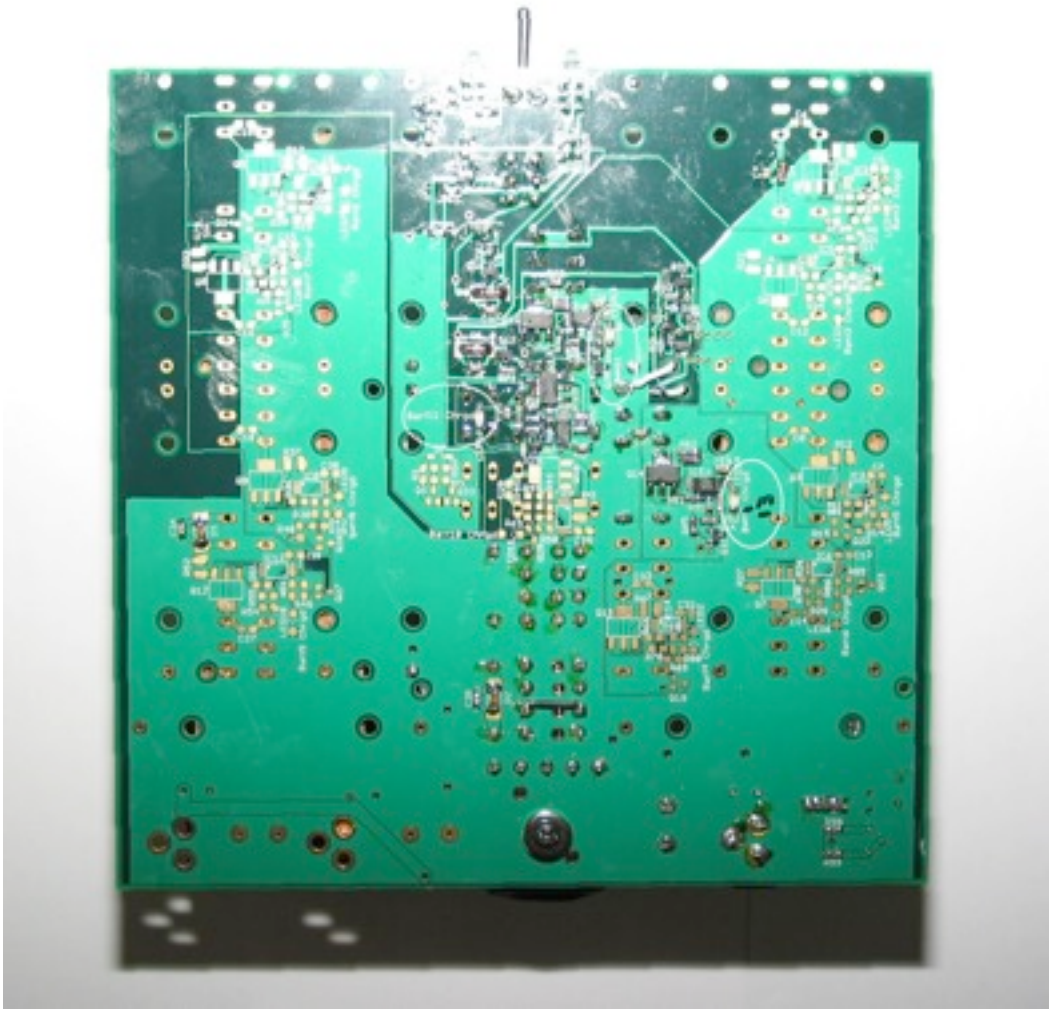
Take care in removing the spent batteries so you don't short across metal parts. The circuit board, once removed from the chassis should be placed on a non-conductive low-static surface. A small screwdriver can be used to pry-up the positive end and then the battery can usually be removed with fingers. Even if they will not fully charge, they may have dangerous potential. Dispose of them carefully, properly and preferably in the discharged state. Avoid flammable containers and do not put in water.

Install fresh batteries in all locations taking care to get the orientation correct. Since they are in parallel, putting one in the wrong orientation can cause extremely large currents, sparks and heating. Installing two parallel batteries both in the wrong orientation will damage the chargers on the circuit board.

5.2. Replacing a defective battery

If one battery fails prematurely, it can be identified by the LEDs on the bottom of the board. The failed battery **PAIR** must be replaced, not just one battery. The same battery type must be used. Substitution of other types is hazardous and will invalidate the warranty. The photos on the following pages and the board silkscreen identify groups Batt11, Batt12 and Batt13. Each of these is a battery pair.


Batt13
Batt12
Batt11
Tenergy



One can remove the board, put it on a non-conductive surface, connect the AC adapter and then check all 3 bottom-side LEDs shown in the three white ellipses above. If the LED on the bottom corresponding to Batt11 does not ever illuminate while the AC adapter is connected over a long period of time and the other two LEDs do illuminate, then one of the two batteries of Batt11 pair is defective. Both batteries of Batt11 must be replaced.

Specifications

Inputs

1. 12VDC AC adapter, 70W, 2.5mm connector center positive

Outputs

1. Neutrik 5-pin high-current connector, +12V and Ground Return

Controls

1. Front panel selector two position toggle with momentary third position

Compatibility

The Monolith is designed to work with the Pace-Car, Pace-Car USB, Off-Ramp 3 and Off-Ramp Turbo 2

Included

1. Monolith
2. Umbilical Cable
3. User Guide

Options

1. 70W 12VDC AC adapter
2. Special Umbilical with in-line fuse